

REMARKS

Applicants have submitted Replacement Sheets of FIG. 1 and FIG. 2. The reference numeral 44 had been used twice in FIG. 1 and FIG. 2, once to refer to a pump and a second time to refer to a gas outlet. In the Replacement Sheets, the gas outlet is now referred to with reference numeral 47.

In FIG. 1, the valve of conduit 45 was indicated with reference numeral 46. However, in FIG. 2, the valve was indicated with reference numeral 48 and the dry sour gas inlet was indicated with reference numeral 46. Applicants' specification at page 9, lines 14-28, describes the FIG. 2 features of the Joule-Thompson valve 48 or other suitable expansion means, such as a turbo expander, and dry sour gas inlet 46. Applicants' Replacement Sheet of FIG. 1 indicates the valve with reference numeral 48. Applicants specification at page 9, lines 6-13, indicates that "[r]eference is now made to Figure 2 showing a further embodiment of the present invention. In this further embodiment dehydrated gas is treated to remove sour components from it. The dehydration process is discussed with reference to Figure 1, and will not be repeated here. Parts having the same function as parts shown in Figure 1 get the same reference numeral."

In FIG. 2, reference numeral 45 had been used twice, once to refer to the conduit through which the dry sour gas exits the second flash tank 40, and a second time to refer to conduit 65 downstream of heat exchanger 22. Applicants' Replacement Sheet of FIG. 2 has replaced the reference numeral 45 downstream of heat exchanger 22 with reference numeral 65.

Applicants have amended the specification to correspond with the changes to the Figures. The paragraph at page 8, lines 3-6, has been amended to correspond to Replacement Sheet FIG. 1 that conduit 45 may comprise a Joule-Thompson valve 48. The paragraph at page 9, lines 14-28, describes FIG. 2 and the dry sour gas inlet 46 and Joule-Thompson valve 48.

The paragraph beginning at page 7, line 18, and ending at page 8, line 2, has been amended to recite "first vessel 12" as shown in FIG. 1 and the Replacement Sheet of FIG. 1.

The paragraph beginning at page 9, line 14, and ending at page 9, line 28, has been amended to recite gas outlet 47.

The paragraph beginning at page 11, line 3, and ending at page 11, line 10, has been amended by inserting that the dry sweetened gas is then fed to the intermediate heat exchanger 22 and from there to an end user (not shown). The amendment is to describe the process downstream of heat exchanger 36 to the end. The amendment is based on FIG. 2 and is similar to page 8, lines 3-6, describing a similar part of the process with reference to FIG. 1.

New independent claim 25 contains subject matter from original claims 1 and 2 where the phrase "cooling the natural gas feed stream in a first vessel to a first operating temperature at which hydrates are formed", originally appearing in claim 1, has been replaced with "dehydrating the natural gas feed stream in a first vessel." Applicants' specification at page 3, lines 20-22, discloses sequentially dehydrating and sweetening the natural gas feed stream in a broad sense without particular limitations such as cooling to a first operating temperature at which hydrates are formed. Several methods of dehydrating are disclosed at page 2, lines 4-8. Applicants' specification at page 3, lines 13-15, discloses dehydrating a natural gas feed stream. Applicants respectfully suggest that Applicants' specification discloses that many kinds of dehydrating prior to sweetening, i.e., removing of sour species, can be employed. Applicants' new claim 25 does not require a modification of the remaining features of the claim to compensate for the amendment, as any dehydrated natural gas stream can be sweetened using the remaining steps of the invention. Applicants' specification at page 3, lines 16-19, discloses sweetening without any step of dehydrating.

The phrase "cooling the natural gas feed stream in a first vessel to a first operating temperature at which hydrates are formed" has been removed from original claim 1 and a similar phrase has been inserted into new dependent claim 26.

Applicants' new dependent claims 27-48 are similar to original claims 3-24, respectively.

Priority

The Office Action at page 2 indicates that receipt is acknowledged of papers submitted under 35 U.S.C. 119 (a) - (d), which papers have been placed of record in the file.

Claim rejections under 35 U.S.C. 102(b) as being anticipated by Williams, Klass, and Blanchard

Claims 1 and 6 have been rejected under 35 U.S.C. 102(b) as being anticipated by Williams et al. ("Williams") (U.S. Patent No. 6,111,155). Claim 1 has been rejected under 35 U.S.C. 102(b) as being anticipated by Klass ("Klass") (U.S. Patent No. 4,147,456). Claims 1-5 and 14-16 have been rejected under 35 U.S.C. 102(b) as being anticipated by Blanchard ("Blanchard") (U.S. Patent No. 3,537,270).

Applicants respectfully traverse the rejections. Reconsideration and withdrawal of the rejections are respectfully requested in view of the amendments and remarks.

Anticipation requires that a reference teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See MPEP §2131.

Williams Abstract discloses a process for producing natural gas hydrate comprising three states (i), (ii), and (iii). Williams column 1, lines 17-21, discloses that hydrates can only be formed by a limited range of gaseous compounds including methane, ethane, propane, butane, carbon dioxide, hydrogen sulphide, tetrahydrofuran, and chlorofluorocarbons. The table at Williams column 1 discloses various gaseous substances that form hydrates and various gaseous substances that do not form hydrates. Williams column 1, lines 50-55, discloses that according to the Williams invention a method of producing a gas hydrate from an hydrate forming gas comprises passing the gas into an hydrate forming region in which hydrate of the gas is formed and passing residual gas which has not formed hydrate in said region from said region into at least one other hydrate forming region in which hydrate of said gas is formed. Williams column 3, lines 32-40, discloses the Williams natural gas hydrate

forming plant in Figure 5 comprising a plurality of successive hydrate forming stages exemplified in Figure 5 by a stage (i), stage (ii), and stage (iii).

Applicants respectfully suggest that Williams does not anticipate, disclose, or suggest Applicants' process comprising dehydrating a natural gas feed stream in a first vessel; removing from the first vessel a stream of dehydrated gas; cooling the dehydrated gas in a second vessel to a second operating temperature at which solids of the sour species are formed or at which the sour species dissolve in a liquid; and removing from the second vessel a stream of dehydrated sweetened gas. Applicants respectfully suggest that the hydrates formed in Williams comprise numerous hydrates and that in the various Williams stages there is no indication of what hydrates are being formed and what hydrates are being removed.

Applicants also respectfully suggest that Williams does not specifically disclose removing sour species. Applicants also respectfully suggest that even if sour species were removed in the Williams process, there is no indication that Williams would provide for dehydrating followed by removing of the sour species. Applicants respectfully suggest that the various stages of Williams may provide for various hydrates being formed and removed from each of the different stages with no distinction of dehydrating followed by removing of the sour species.

Klass Abstract discloses a method providing for storing fuel gas by pumping the fuel gas into the lower portion of a storage vessel and automatically forming a solid fuel gas hydrate due to the vessel being positioned beneath the surface of a body of water. Klass column 2, lines 42-52, discloses that the term fuel gas as used in the Klass disclosure and claims includes natural gas, substitute natural gas (SNG) and any other gaseous organic which forms a solid hydrate with water under pressure and temperature conditions obtainable at reasonable water depths. Methane is the major component of natural gas, SNG and other fuel gases and is known to form the hydrate $\text{CH}_4 \cdot 7\text{H}_2\text{O}$. Ethane, propane and normal-butane hydrates at lower temperature and/or higher pressure conditions. Higher hydrocarbons are too large to enter the hydrate crystal lattice and thus do not hydrate under any conditions. Klass column 2, lines 32-35, discloses that the hydrate formation temperatures and pressures also vary somewhat for gaseous components of the fuel gas other than methane, such as ethane, propane and butane.

Klass column 3, lines 13-51, generally discloses the Klass storage vessel where the Klass fuel gas is introduced to the bottom portion of the Klass storage vessel and is subjected to hydrate-forming pressure and temperature conditions due to the vessel's location beneath the surface of a body of water and solid fuel gas hydrate is spontaneously formed. Klass emphasizes the equilibrium that is established between the gas in the Klass decomposition zone and the solid hydrate in the hydrate formation zone. Klass indicates that opening the gas outlet valve permits the flow of gas from the hydrate decomposition zone to the gas outlet, providing an automatic pressurized withdrawal system. As the gas is withdrawn from the top of the storage vessel, the solid hydrate will automatically move upward toward the hydrate decomposition zone.

Applicants respectfully suggest that Klass does not anticipate, disclose or suggest Applicants' process comprising dehydrating a natural gas feed stream in a first vessel; removing from the first vessel a stream a dehydrated gas; cooling the dehydrated gas in a second vessel at which solids of the sour species are formed or at which the sour species dissolve in a liquid; and removing from the second vessel a stream of dehydrated sweetened gas as recited in Applicants' independent claim 25 and the claims depending therefrom. Applicants respectfully suggest that there is no disclosure in Klass of a process comprising dehydrating followed by removing of sour species.

Blanchard Abstract discloses the Blanchard process for dehydrating high pressure gas comprising flashing the high pressure gas into a first vessel to obtain a low pressure gas of reduced water content; heating the low pressure gas by heat exchange with the high pressure gas; and melting hydrates formed in the first vessel upon flashing the high pressure gas, using as a heating medium the heated low pressure gas. Blanchard column 4, lines 49-51, discloses that gaseous hydrocarbons are removed from the Blanchard dehydration vessel via line 40 after passing through temperature control valve 39. Blanchard column 5, lines 54-62, discloses that the lowering of the pressure through expansion valve 14 results in substantial cooling of the gas causing hydrates to form. These hydrates are generally white and crystalline in appearance. These hydrates consist of associated solid H₂O and hydrocarbons, such as methane, ethane, propane or butane. The hydrates are formed at temperatures

as high as 90 to 100° F, but more frequently at about 55 to 80° F. These hydrates are caught by the coils and melted.

Applicants respectfully suggest that Blanchard does not anticipate, disclose, or suggest the dehydrating of a natural gas feed stream followed by removing sour species as recited in Applicants' independent claim 25 and the claims depending therefrom.

The Office Action, in the paragraph bridging pages 2 and 3, indicates that Blanchard shows a system for dehydrating natural gas by cooling the incoming stream and forming hydrates. The dry gas leaving dehydrating tank 31 through line 40 enters a second tank which cools the gas further to produce sweetened gas. Applicants respectfully traverse such statements. Applicants respectfully suggest that there is no disclosure in Blanchard that the dry gas entering the second tank would further produce sweetened gas.

As noted hereinabove, Blanchard column 4, lines 49-51, discloses that gaseous hydrocarbons are removed from the dehydration vessel via line 40 after passing through temperature control valve 39. Blanchard column 4, lines 52-63, discloses further details regarding the flow into the heat exchange vessel 7. Blanchard column 4, line 64 - column 5, line 2, refers to a specific example of a feed gas which is flashed in dehydration vessel 31 and is heated in line 24 by exchange with high pressure gas in heat exchange vessel 7. Product dehydration gas withdrawn from the three-way valve in line 24 is passed through control valve 41 and into coil 34 in the lower part of dehydration vessel 31 where it melts hydrates formed upon rapidly expanding high pressure gas into dehydration vessel 31. The product dehydrated gas is withdrawn in line 42 and passed to further processing, such as removal of propane and/or butane by a gas plant, or passed directly to a gas transmission line. Applicants respectfully suggest that there is no anticipation, disclosure or suggestion that sour species are being removed at any particular stage of the Blanchard process.

Claim rejections under 35 U.S.C. 103(a) as being unpatentable over Blanchard in view of Williams

Claims 6-13 and 17-24 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Blanchard ("Blanchard") (U.S. Patent No. 3,537,270) in view of

Williams et al. ("Williams") (U.S. Patent No. 6,111,155). Applicants respectfully traverse the rejections. Reconsideration and withdrawal of the rejections are respectfully requested in view of the amendments and remarks.

Anticipation requires that a reference teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See MPEP §2131.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). See MPEP §2142.

Applicants have discussed Blanchard and Williams hereinabove and incorporate such discussion herein at this point by reference.

Applicants respectfully suggest that the Office Action is using improper hindsight to combine Blanchard, that does not anticipate, disclose or suggest a process comprising dehydrating a natural gas feed stream in a first vessel followed by cooling and removing sour species, with Williams, that also does not anticipate, disclose or suggest a process comprising dehydrating a natural gas feed stream followed by cooling and removing sour species, to arrive at Applicants' claimed invention. Applicants respectfully suggest that the improper combination of Blanchard and Williams may provide for a process where hydrates would be removed at various stages with no distinction between dehydrating and removing the sour species and also with no distinction regarding what hydrates are being formed and/or removed at each stage. Applicants respectfully suggest that the improper combination of Blanchard and Williams does not anticipate, disclose, or suggest Applicants' process recited in Applicants' independent claim 25 and the claims depending therefrom.

CONCLUSION

Applicants respectfully request reconsideration and withdrawal of the claim rejections under 35 U.S.C. 102(b) and 35 U.S.C. 103(a). Applicants further respectfully request entry and consideration of the above amendments and remarks to advance the above-identified application to allowance.

Respectfully submitted,

ROBERT AMIN, et al.

A handwritten signature in cursive script, reading "Reece A. Scott", written in black ink over a horizontal line.

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